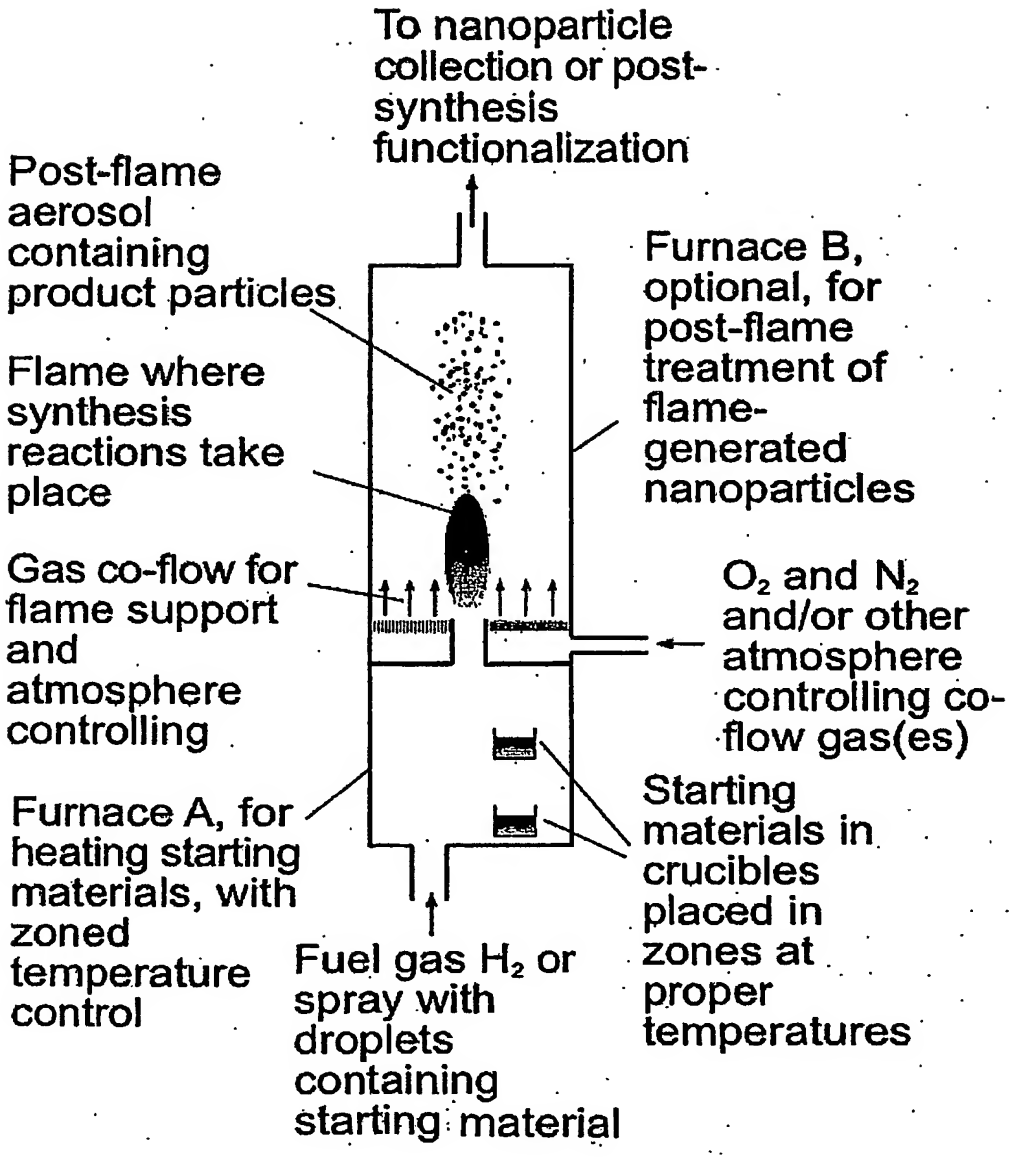
To nanoparticle collection or post-synthesis functionalization
Post-flame aerosol containing product particles
Flame where synthesis reactions take place
Gas co-flow for flame support and atmosphere controlling
Furnace A, for heating starting materials, with zoned temperature control
Fuel gas H_2 or spray with droplets containing starting material
Furnace B, optional, for post-flame treatment of flame-generated nanoparticles
O_2 and N_2 and/or other atmosphere controlling co-flow gas(es)
Starting materials in crucibles placed in zones at proper temperatures

Figure 1

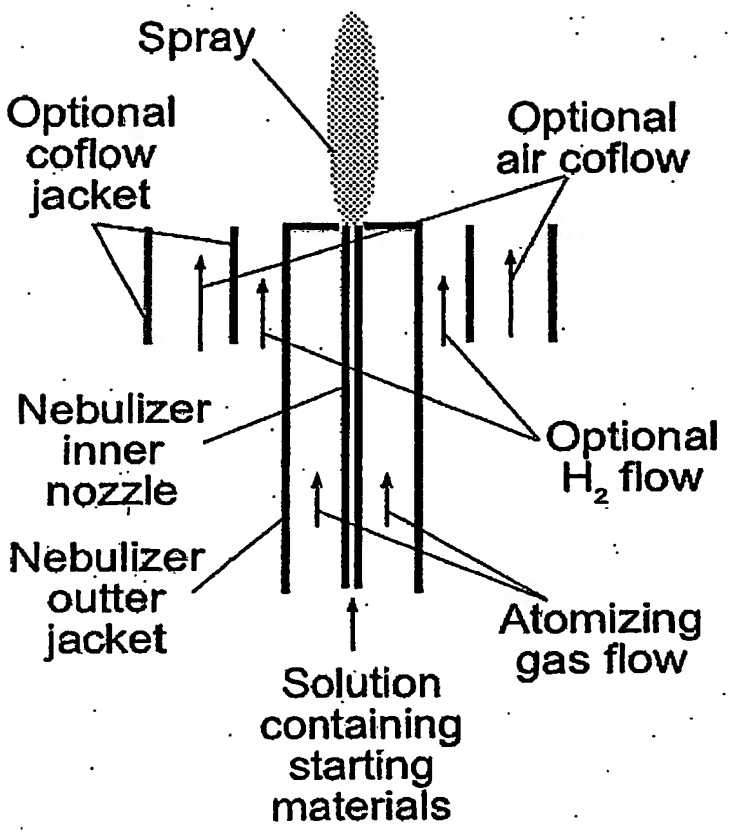
Spray
Optional coflow jacket
Optional air coflow
Nebulizer inner nozzle
Optional H_2 flow
Nebulizer outter jacket
Atomizing gas flow
Solution containing starting materials

Figure 2

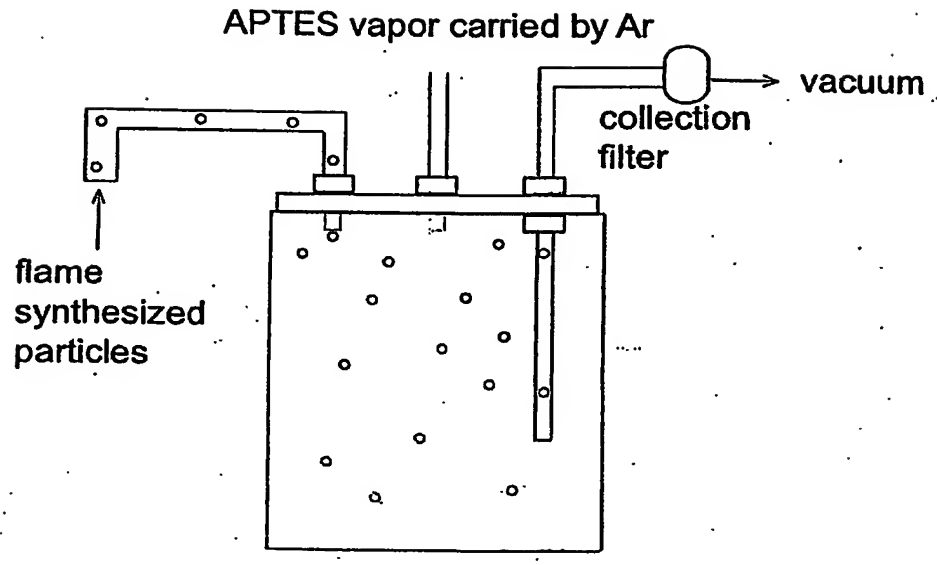
APTES vapor carried by Ar
vacuum
collection
filter
flame
synthesized
particles

Figure 3

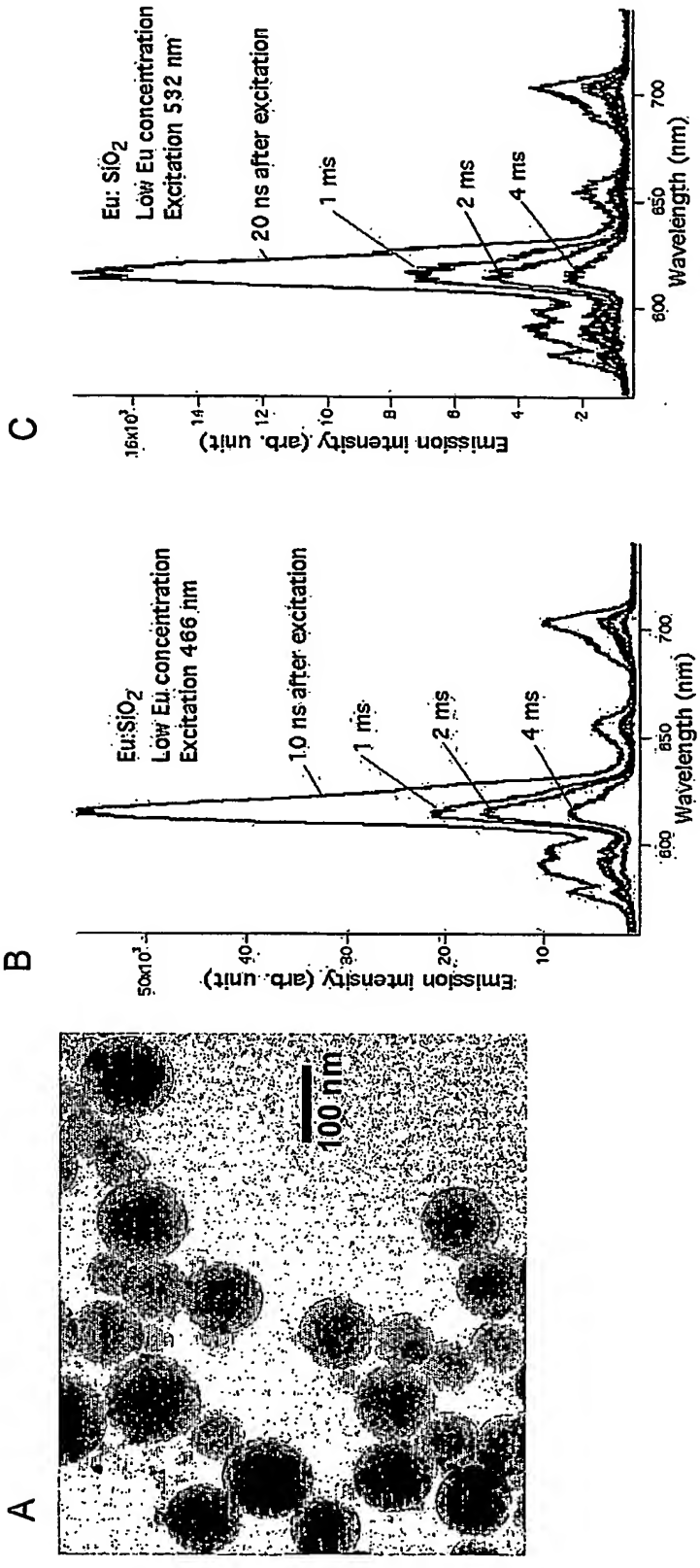
A
100 nm
B
Eu:SiO2
Low Eu concentration
Excitation 466 nm
10 ns after excitation
1 ms
2 ms
4 ms
Emission intensity (arb. unit)
50x10^3
40
30
20
10
600
650
700
Wavelength (nm)
C
Eu: SiO2
Low Eu concentration
Excitation 532 nm
20 ns after excitation
1 ms
2 ms
4 ms
Emission intensity (arb. unit)
16x10^3
14
12
10
8
6
4
2
600
650
700
Wavelength (nm)

Figure 4

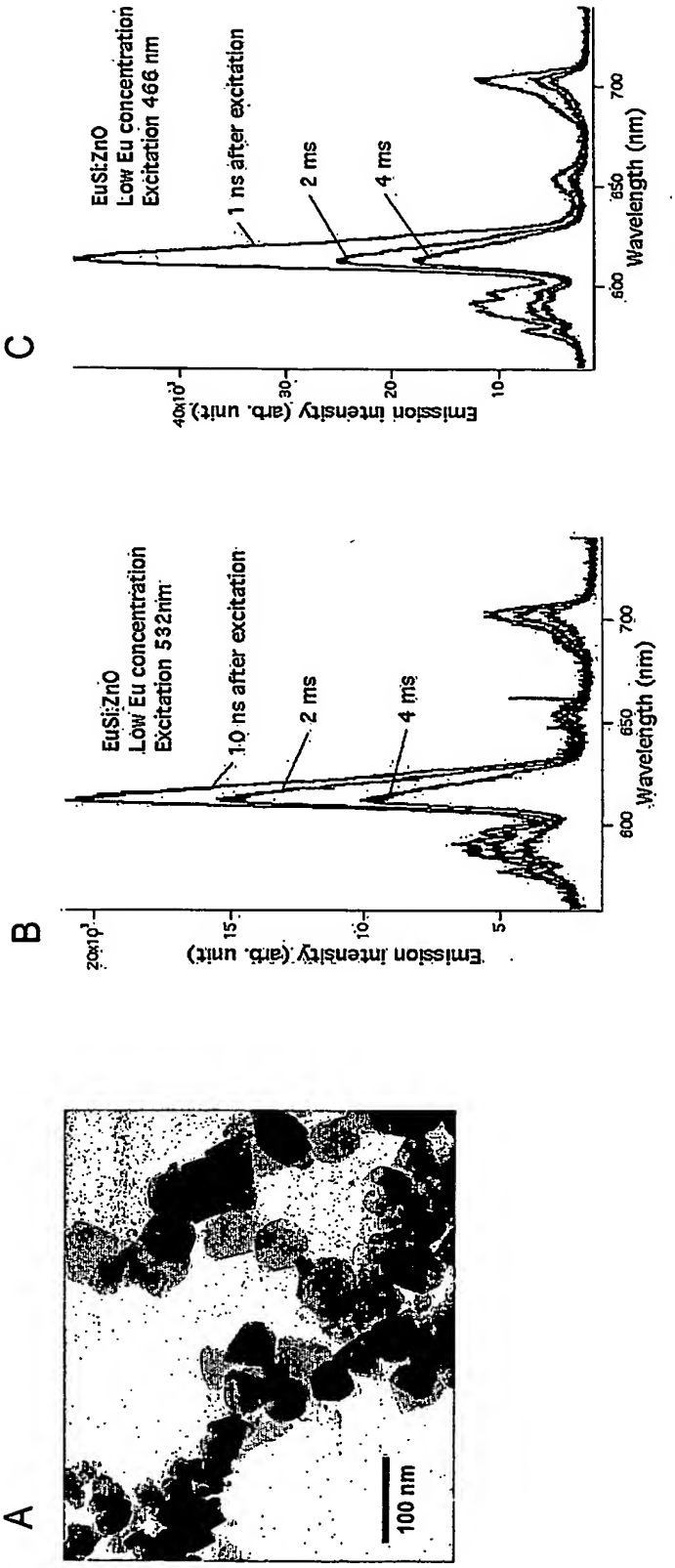
A
100 nm
B
EuSi:ZnO
Low Eu concentration
Excitation 532nm
1.0 ns after excitation
2 ms
4 ms
Emission intensity (arb. unit)
Wavelength (nm)
C
EuSi:ZnO
Low Eu concentration
Excitation 466 nm
1 ns after excitation
2 ms
4 ms
Emission intensity (arb. unit)
Wavelength (nm)

Figure 5

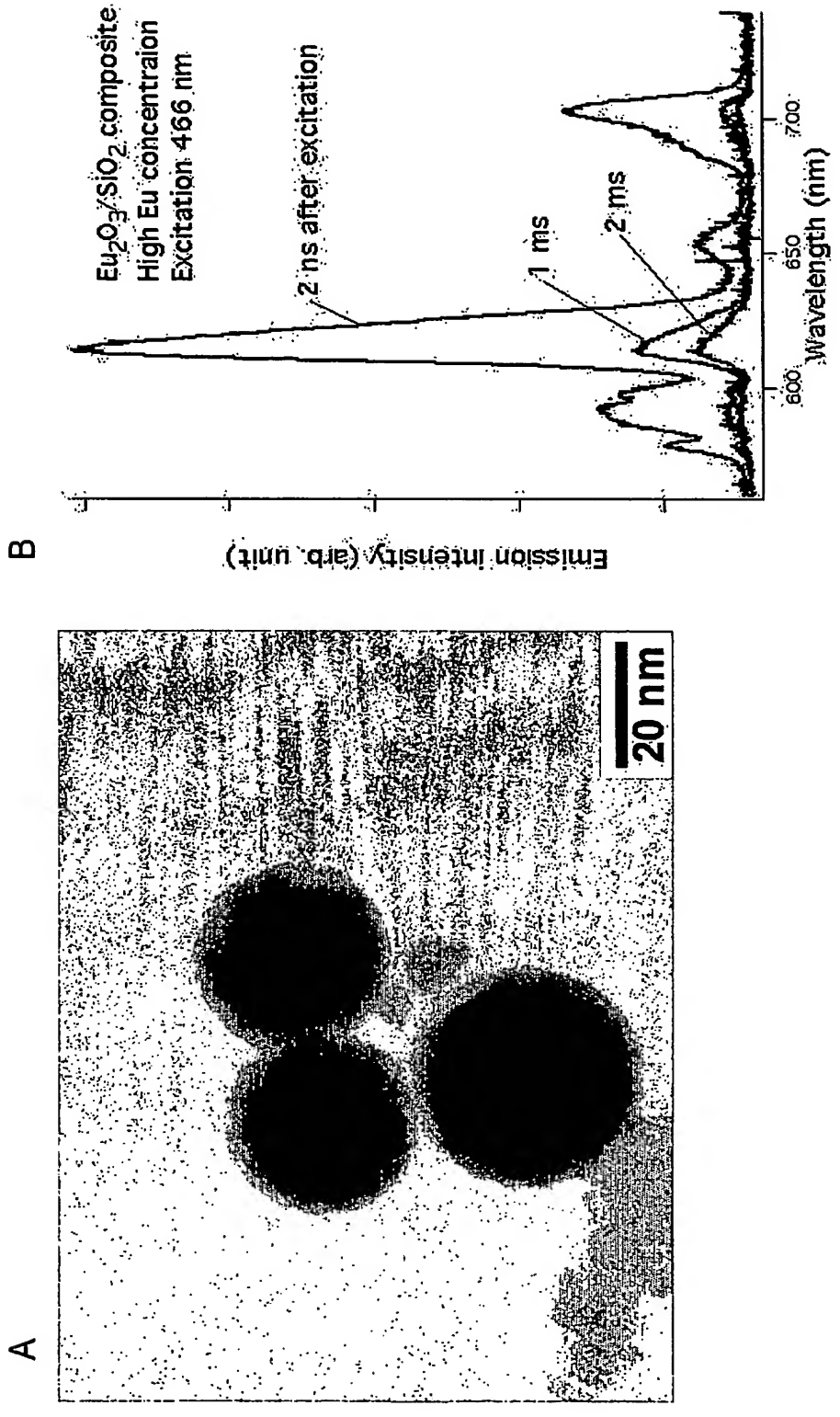
A
20 nm
B
Emission intensity (arb. unit)
Wavelength (nm)
600
650
700
Eu_2O_3/SiO_2 composite
High Eu concentraion
Excitation 466 nm
2 ns after excitation
1 ms
2 ms

Figure 6

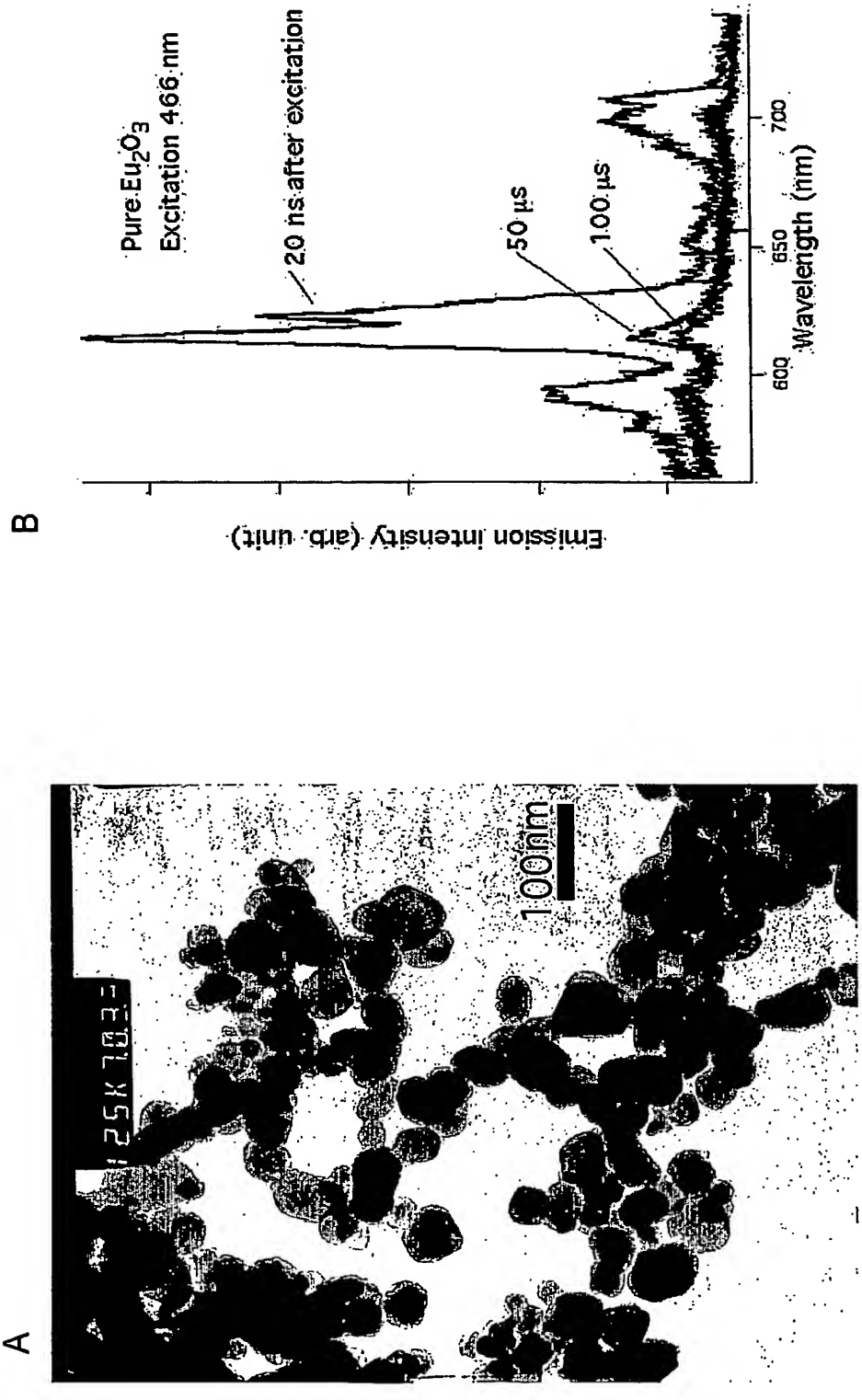
A
125K 7833
100nm
B
Pure Eu_2O_3
Excitation 466 nm
20 ns after excitation
50 µs
100 µs
600
650
700
Wavelength (nm)
Emission intensity (arb. unit)

Figure 7

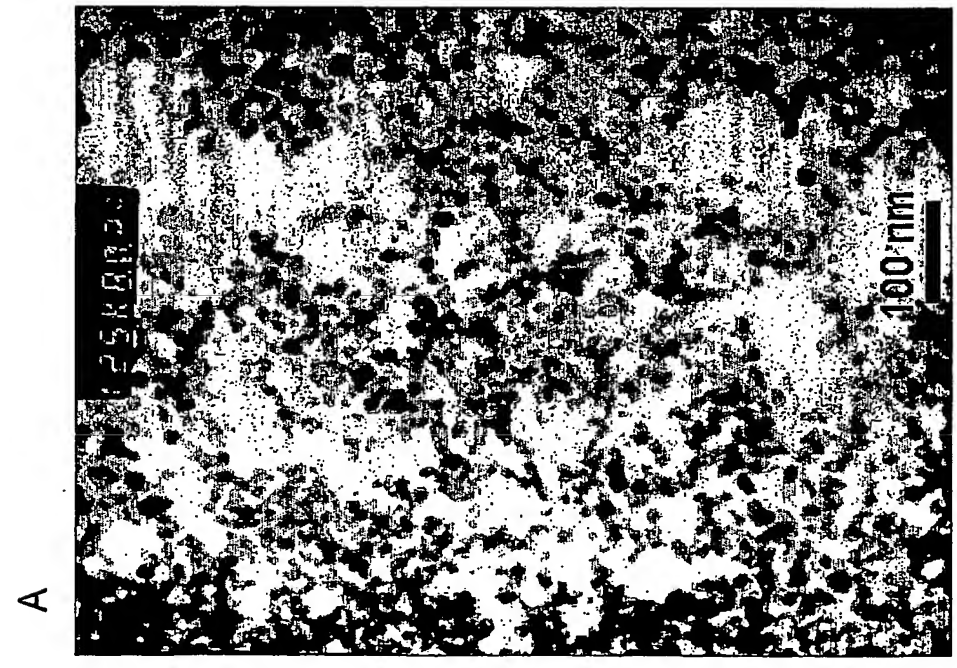
A
100 nm
B
Eu:Y2O3
Excitation wavelength 260 nm
2 ns after excitation
2 ms after excitation
Intensity (arb. units)
600
650
700
Wavelength (nm)

Figure 8

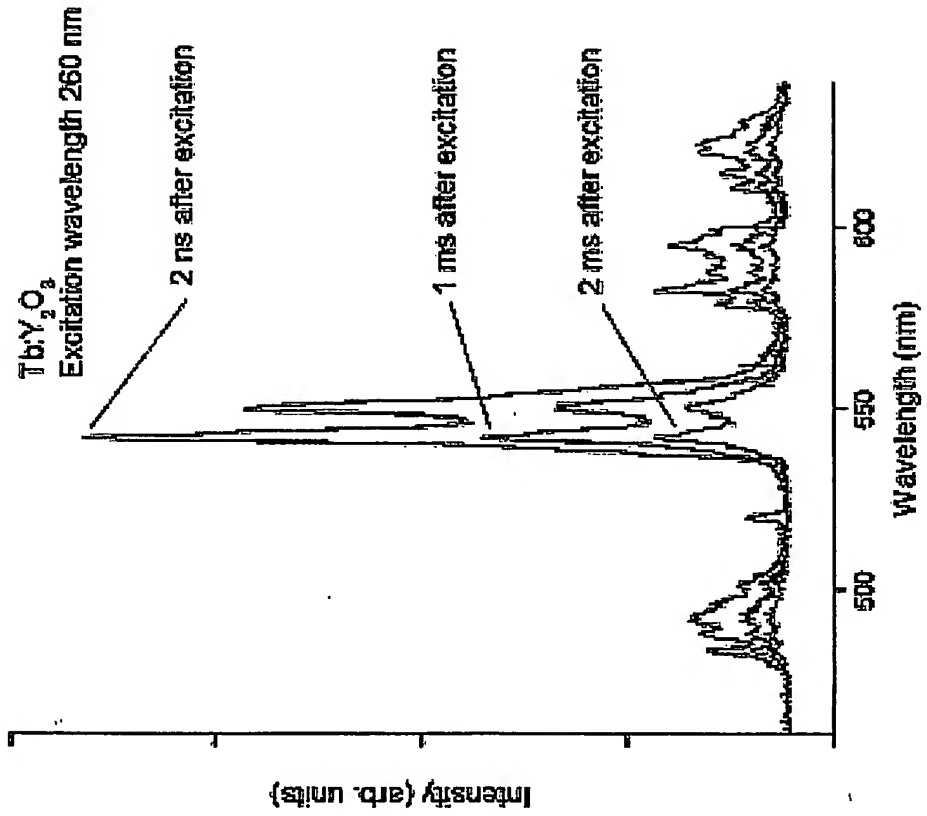
Tb:Y2O3
Excitation wavelength 260 nm
2 ns after excitation
1 ms after excitation
2 ms after excitation
Intensity (arb. units)
500
550
600
Wavelength (nm)

Figure 9

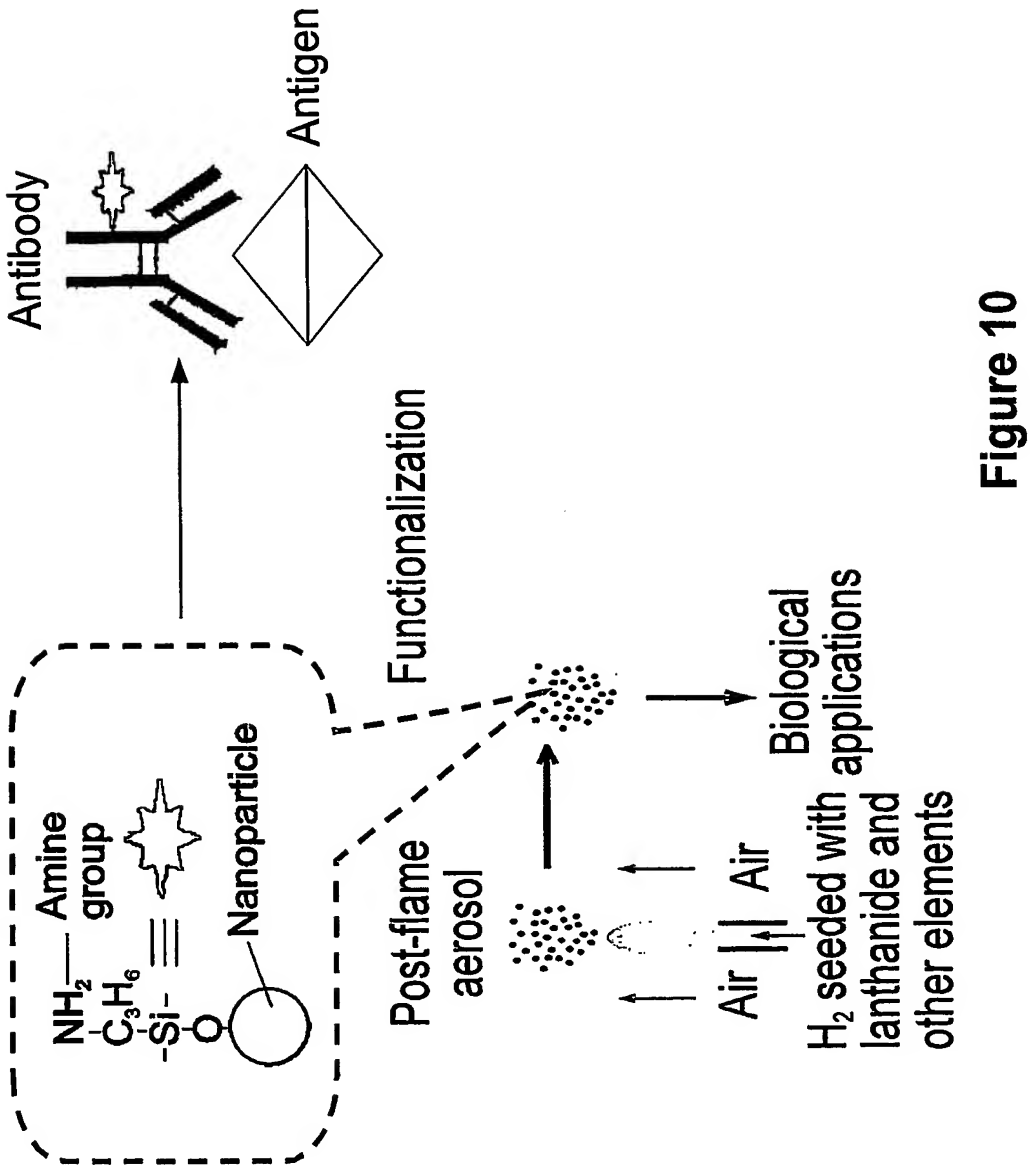
Antibody
Antigen
Functionalization
Amine group
NH_2
C_3H_6
Si
O
Nanoparticle
Post-flame aerosol
Air
Air
H_2 seeded with lanthanide and other elements
Biological applications

Figure 10

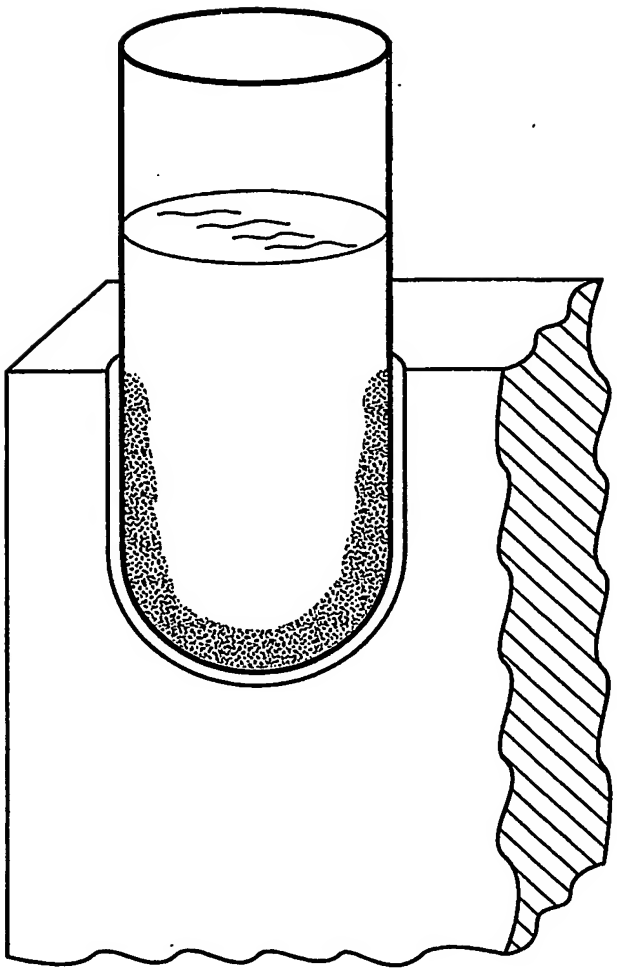

FIG. 11